REMARKS

In the above-identified Office Action the Examiner has objected to the disclosure because of a failure to insert the 371 information. By the above amendment applicant has corrected this matter and has inserted the 371 information.

The Examiner has also provisionally rejected claims 1-3, on the grounds of non-statutory obviousness type double patenting over co-pending application 11/005,180. Applicant hereby encloses a terminal disclaimer over such co-pending application and, as a result, believes that this rejection is considered obviated.

Claims 1-7 have been rejected as unpatentable over Japanese Patent Abstract 11-302096 (JP '096) in view of Japanese Patent Abstract 2003-002782 (JP '782). The Examiner is apparently combining the CZ Method and apparatus for producing a seed crystal and a single crystal in JP '096 with the magnetic cusp field applied by JP '782.

Applicant has amended the claims so that they now recite that both a horizontal magnetic field is applied to the melt as well as heating the seed crystal by radiant heat. This combination is not found in the art of record.

The invention of JP '782 is directed to a method for pulling silicon single crystal by Czochralski method in which a cusp field is applied. While a magnetic field is applied to a melt in both JP '782 and the subject invention, the horizontal magnetic field and applying a cusp field are absolutely different.

In the subject invention, it is possible to decrease the temperature difference ΔT between the seed crystal and the melt by applying a horizontal magnetic field. Applying a horizontal magnetic field to the melt suppresses the convection of the melt, and heat transfer in the melt is therefore suppressed. Accordingly, the temperature of the area of the melt where the seed crystal contacts with the melt surface cannot be easily increased, and then the temperature gradient of the melt surface increases in a radial direction (see Figure 1).

Here, when the electric power applied to the main heater is increased in order to maintain a target temperature of the above-mentioned portion of the melt, the temperature of the seed crystal increases due to the increased radiant heat of the main heater, and the temperature of the seed crystal comes close to the temperature of the center point of the melt (which is higher temperature than the seed crystal). As a result, the temperature difference

ΔT between the seed crystal and the melt decreases.

Thus, applying the horizontal magnetic field causes the temperature difference ΔT between the seed crystal and the melt to decrease. Further, the maximum resolved shear stress MRSS (MPa) in the seed crystal (namely, maximum value of a thermal stress applied to the seed crystal at the time of contact with the melt), is less, and occurrences of dislocations are suppressed.

On the other hand, as taught by JP '782, applying a cusp field to a melt generates a central magnetic field having no magnetic field strength at the center point of the melt surface. Since the magnetic field strength near the center point is low, there is almost no melt convection suppressing effect near the center of the melt surface. Thus, the temperature gradient in the melt surface radial direction is smaller than when a horizontal magnetic field is applied; as now recited, by the structure of the subject invention, radiant heat from a main heater transfers to the center point of the melt surface easily.

In JP '782, therefore, in order to maintain a desirable temperature at the center point of the melt surface, the power applied to the main heater has to be lower than when a horizontal field is applied (when the power is lower, the temperature of the seed crystal is difficult to increase).

From the foregoing, it can be seen that it is impossible to decrease the temperature difference ΔT between the seed crystal and the melt by applying a cusp field.

Therefore, the application of a horizontal magnetic field and a cusp field result in different convections generated in the melts. As a result, if JP '096 and JP ' 782 were to be combined, such a combination cannot make the subject invention obvious.

Applicant here by requests reconsideration and re-examination thereof.

With the above amendments and remarks applicant believes the application to be ready for allowance and earnestly solicits and early notice of same. Should the Examiner be of the opinion that a telephone conference would expedite prosecution of the subject application he is respectfully requested to call the undersigned at the below listed number.

Respectfully submitted,
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January 10, 2008
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